Computer-based carton testing made easy

Manual testing.

Traditionally, folding carton converters have relied on manual test procedures to determine the dimensional quality of their carton blanks. Using devices such as glass scales – like magnifying glasses – quality control personnel perform occasional visual checks of production cartons and when dies are set up at model change. Now Indocomp Systems Inc. of the United States offers the ACT II system, a computer-based carton checking method which is much faster and more precise than manual testing.

Manual testing has three major shortcomings:

- *Time consuming* – typically, it takes more than 30 minutes to visually check a carton and write a report. This means few cartons from a run can be checked unless there is idle press time until the results are available.
- Operator *dependent* — results can vary with the operator's eyesight and his alertness and concentration level at the time of the test.
- *Provide little documentation* – manually prepared reports do not lend themselves to automatic data analysis to determine quality trends. When reports are handwritten, there is the increased danger of misinterpretation of data.

The ACT II system – now being used by converters in the UK and in the US – is a statistical quality control device which can rapidly and accurately conduct complex physical inspections of folding cartons. It replaces manual and subjective quality control inspection techniques with a fast, automatic, quantitative, computer-controlled system.

The functions of the system are relatively simple. A precision X-Y table indexes a height gauge in a predetermined search pattern over the carton sample. The gauge identifies the location of cut edges and scores and determines the height and symmetry of each score. This data is then printed out on a report form for use by quality control personnel in determining machine adjustments to bring the carton blank back to specified tolerances.

Simple operation

All the operator has to do is mount the flat carton blank to be checked on the X-Y table, then select and enter via the keyboard the proper model number for the carton design and size. The system does the rest automatically, in just minutes.

The X-Y table begins moving the height gauge from the home position along a path that is preprogrammed for each carton model. Each test begins with the height gauge passing over a gauge block that duplicates a score profile

The ACT II system from Indocomp Systems Inc. of the USA, marketed In Europe by Paragon International Consulting of West Germany.

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of known height (Figure 1). The output signal from the height gauge is automatically calibrated by the software program to correspond to this known height value. This calibration compensates for any drift that may occur in the analog-to-digital electronics as a result of temperature variations, or for any wear in the height gauge.

Figure 2 shows a typical path travelled by the height gauge to precisely locate the position of 74 scores and 32 edges on a quart/litre liquid carton. It travels at high speed between inspection points and low speed during data collection periods. As it crosses the score lines and edges, the system scores 250 height readings for every 6.4 mm (2%“) the gauge travels.

If the height data for a score were plotted against the positioned data (Figure 3), it would look like a typical bell curve with extended tails. From this data, the computer calculates the exact centre point height and symmetry of each score. A similar process determines the location and height of each edge point of the cut carton blank. All computed data points (X and Y co-ordinates, score/edge heights and score symmetry) are stored by the computer for each of the desired inspection points. This information is then used to determine the actual carton dimensions, such as panel widths and flap lengths.

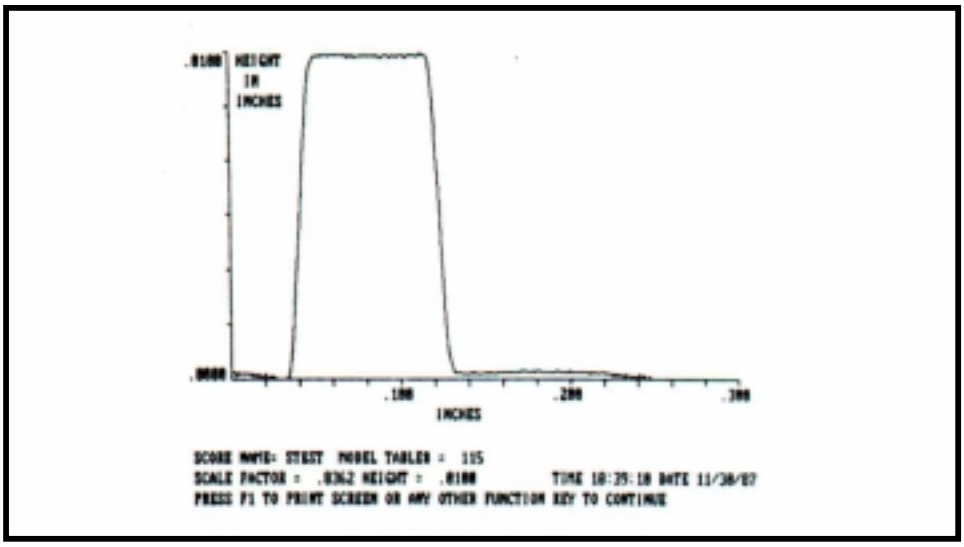

Figure 1: The First step is reading the profile of a gauge block, then automatically calibrating the gauge as needed.

Reports suit user needs

At this point, the basic test is complete, and the operator can request a print-out of the test results. The ACT II system can provide a variety of reports:

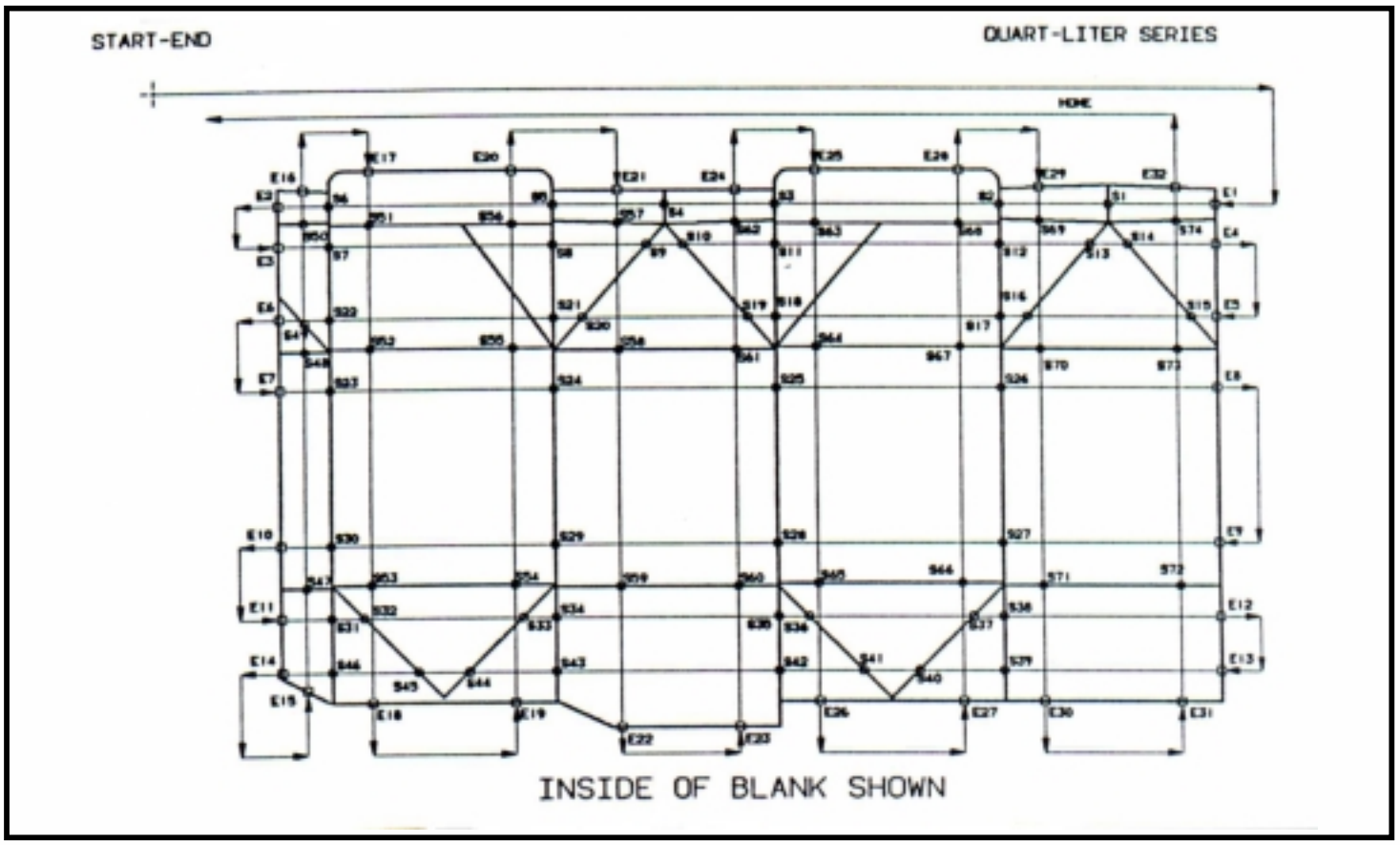

Figure 2: In a typical path, the gauge begins at top left and travels back and forth over a quart/litre Pure-Pak carton.

Pure-Pak carton.

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- *Score/edge dimensional report* – shows all major carton elements (scores and edges) dimensioned accurately in relationship to each other. It can be requested in one of three formats: it can show the actual dimensions (Figure 4); it can compare these dimensions to the nominal or blueprint values stored in the appropriate model table and show only the deviation from standard (Figure 5); or it can show only those dimensions that deviate by more than an allowable tolerance amount (Figure 6).
- *Score quality report* – contains score height and symmetry information (Figure 7) and notes any dimensions which deviate significantly from tolerances.
- *Score/edge profile* – this report shows the detailed graphic profile of any score or edge (Figure 8).
- *Bar graph report* – displays carton quality information (i.e. score height, edge height and score symmetry) in a bar chart format (Figure 9), so problems and trends can be identified at a glance.

The entire process, from carton blank inspection through to the printing of the desired report, takes just eight minutes.

Improved documentation

The system greatly simplifies record-keeping and makes it easy to maintain accurate files of all quality measurements. This can contribute significantly to good production planning by identifying potential problem areas. It can also be a valuable source of documentation should a quality dispute arise with a customer.

For the converter with more than one production facility, the system makes even more sense. An ACT II system can automatically transmit test results from remote plant sites to **a** central office via telephone. The central system stores the telephone number of each remote ACT II unit, then, at a predetermined time (usually in the evening, when telephone rates are lower), the central system automatically dials

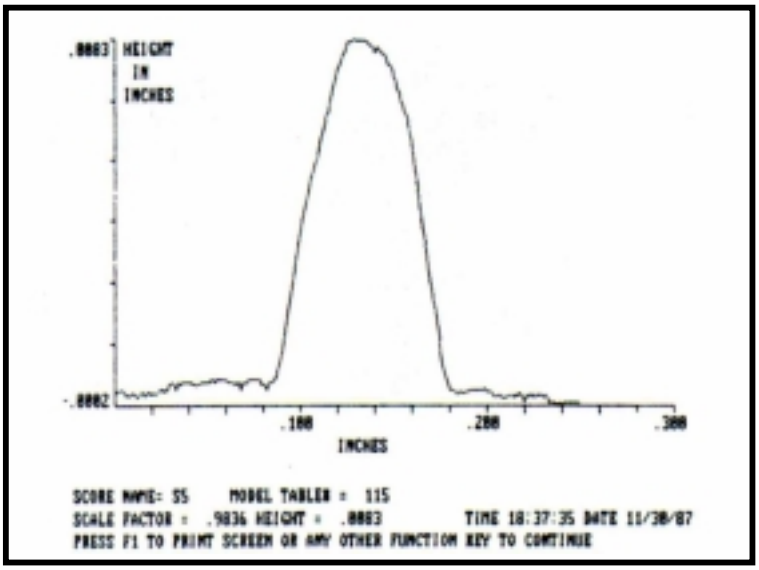

Figure 3: Profile of a typical carton score.

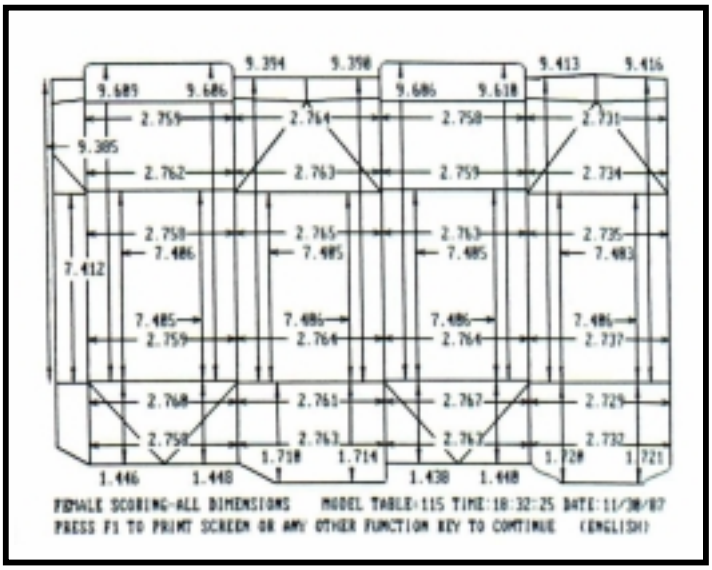

Figure 4: Carton reports can show every carton dimension.

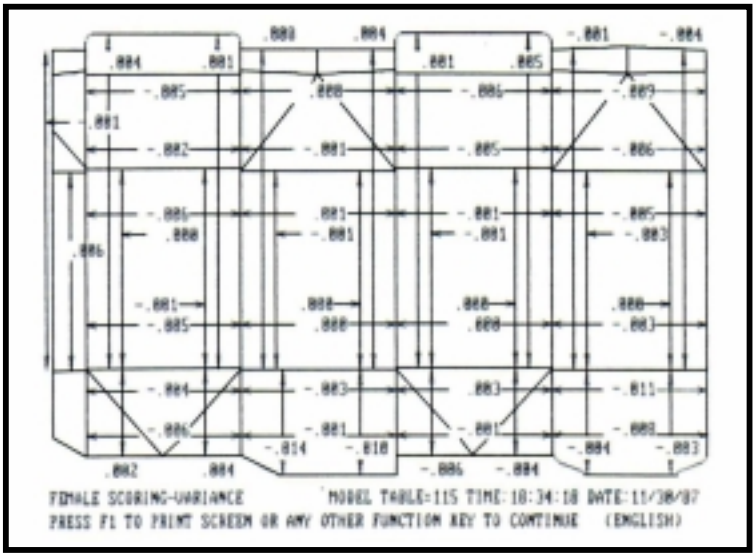

Figure 5: A more common report shows devistions from standard measurements.

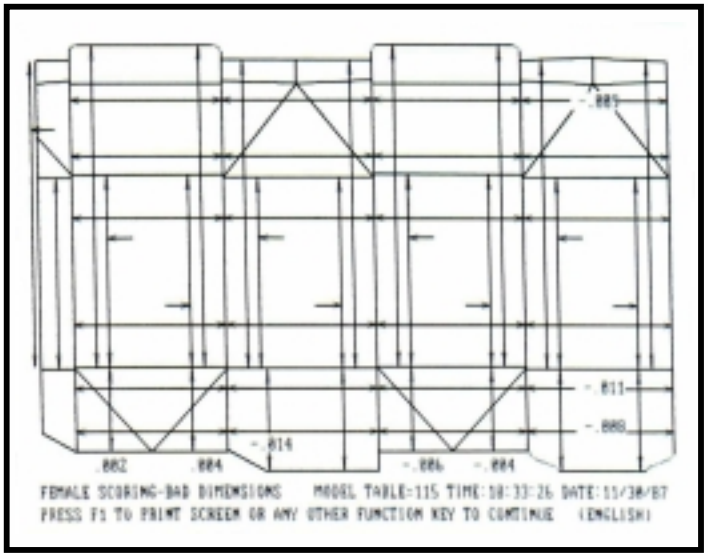

Figure 6: The ACT II system can be instructed to report only dimensions that are out 01 tolerance.

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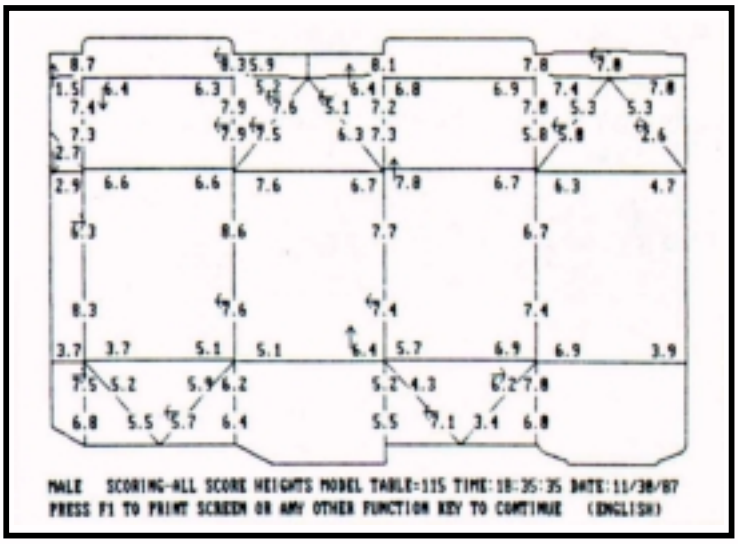

Figure 7: Score heights end symmetry sre also available.

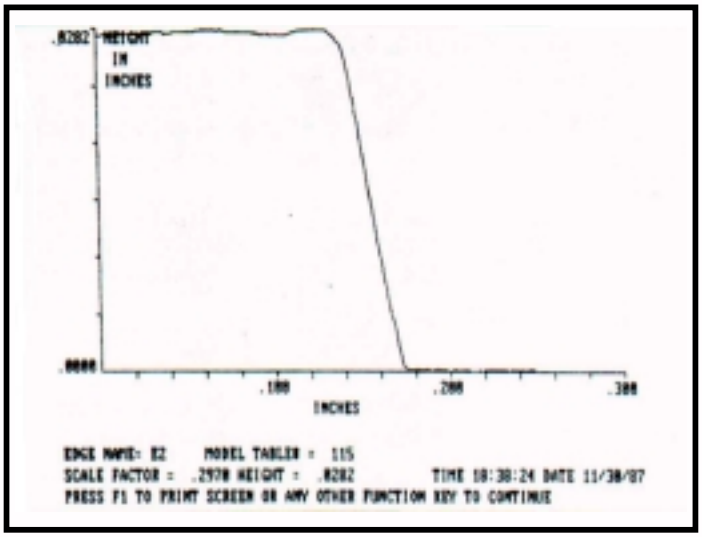

Figure 8: Profile of a **typical** carton edge

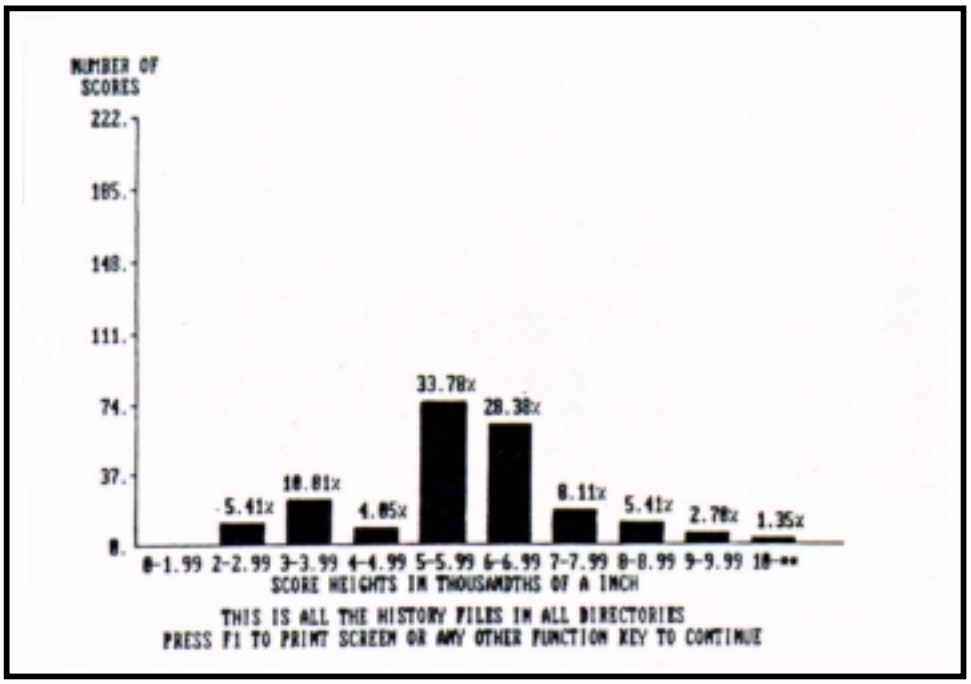

Figure 9: Information csn be provided In **easy-to-read** bar charts.

each remote system and receives the day's test results. All information is stored on the central system's disk drive, where it is available for trend analysis and reporting.

Systems components

The key components of each system are the precision X-Y coordinate measuring table (with 0.025 mm (0.01") repeatability) and a Packard Bell PB266 (IBM AT-compatible) computer with 1 megabyte RAM memory. The system also features a high resolution graphics monitor with keyboard, a high-speed Okidata Microline ML 293 printer-plotter (which operates at up to 240 characters per second), and a microprocessor-based motion controller.

Indocomp Systems Inc. provides software as well as hardware, including a self-diagnostic program for the computer components and a software package tailored to a customer's carton specifications and production requirements.

Future enhancements

Recognising that the typical system is not in constant use, the company plans to introduce several software enhancements to utilise the system's computer for other quality management purposes. These Include a family of application software programs that will allow quality control personnel to perform the following functions:

- organise and present test results using a spreadsheet program;
- store and sort test results using a database management program;
- analyse and interpret test results, and even project trends, using a statistical analysis program;
- display and graph test results using a graphics program; and
- prepare quality reports using a word processor.

Such a package could be utilised any time the system is not being used to run a test. It could operate on either automatically generated (by the ACT II system) or manually entered test data.

Summary

This system provides extremely accurate data in a variety of formats, to enhance the quality control efforts of virtually any folding carton converter. Not only is the data more precise than can be provided by manual testing methods, but it is provided much more quickly. The effects on productivity as well as quality can be substantial.

Personnel presently testing carton blanks in the traditional manner can easily learn to operate and program the ACT II system.